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ORIGINAL ARTICLE OCULOPLASTIC

Epicanthoplasty with Epicanthal Dermatic Tension-Releasing Incision Based on Skin Projection of Inner Canthal Ligament

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Abstract
Background Epicanthoplasty is a reconstructive procedure that eliminates the deformity of the epicanthal fold and provides a more esthetic inner canthus. The epicanthal tension-releasing incision is a core technique of epicanthoplasty. However, which epicanthal dermatic tension-releasing incision most effectively provides epicanthal tension release remains unclear. We designed a novel dermatic tension-releasing incision based on the skin projection of the inner canthal ligament and compared it with the more conventional incision parallel to the lower inner canthal mucocutaneous junction (white line).
Methods From December 2014 to March 2016, 30 patients were divided into two groups according to the type of dermatic tension-releasing incision. Each group comprised 15 patients and 30 eyes. In Group A, incision line a was performed (tension-releasing incision parallel to the lower inner canthal mucocutaneous junction, 4–5 mm away from the mucocutaneous junction). In Group B, incision line b was performed (tension-releasing incision pointed toward the lacrimal lake, along the skin projection of the inner canthal ligament). The defect angles of the two groups were photographed intraoperatively after tension release and analyzed postoperatively.
Results The defect angles in Group B were significantly larger than group A ($P < 0.0001$). All patients obtained an esthetically pleasing inner canthus without hypertrophic scarring or injury to the lacrimal apparatus during the 3- to 24-month follow-up period.
Conclusion An epicanthal dermatic tension-releasing incision based on the skin projection of the inner canthal ligament is more effective and safer than an incision parallel to the lower inner canthal mucocutaneous junction.
Level of Evidence IV This journal requires that authors assign a level of evidence to each article. For a full description of these Evidence-Based Medicine ratings, please refer to the Table of Contents or the online Instructions to Authors www.springer.com/00266.

Keywords Epicanthoplasty · Blepharoplasty · Dermatic tension-releasing incision · Epicanthal fold

Introduction

The epicanthal fold is ubiquitous among Asians. It is found simultaneously with almost all single eyelids. The preseptal part of the orbicularis oculi muscle extends obliquely around the inner canthus [1], and the intermingled muscle fibers and fibrotic tissue connecting the upper preseptal muscle to the lower preseptal muscle in the inner canthus form the epicanthal fold [2]. Many Asian patients undergo simultaneous epicanthoplasty and double-eyelid blepharoplasty to improve the esthetic appearance of the eyelid. The most

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commonly used epicanthoplasty techniques in China are the horizontal incision method [3, 4], Z-plasty [5–8], V–W plasty [5, 9], and Y–W plasty [10]. Epicanthoplasty involves the release of epicanthal tension through an orbicularis oculi myectomy and repair of the defect with a smaller skin flap to create a more esthetic inner canthus [1]. The core principle of plastic surgery is destruction followed by reconstruction. Reconstruction of an improved inner canthal shape is based on the planned destruction of the epicanthal defect. Epicanthal tension-releasing techniques for destruction of the epicanthal deformity have been widely used in the clinical setting [6, 8, 11, 12]. The two most widely used tension-releasing incisions in Chinese patients undergoing epicanthoplasty are an incision parallel to the inner canthal mucocutaneous junction (white line) of the lower eyelid [5, 6] (Fig. 1, line a) and an incision pointing toward the medial-most point of the lacrimal lake [8, 12, 13] (Fig. 1, line c). Which of these methods more effectively relieves epicanthal tension has not been reported. In the clinical setting, we have found that incision lines a and c do not sufficiently release the epicanthal tension because they are located below the inner canthal ligament, which partially limits upward movement of the skin flap.

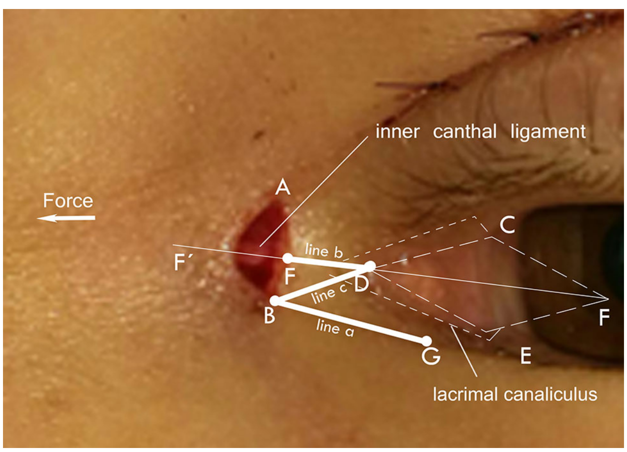

Fig. 1 Epicanthal dermatic tension-releasing incision and location of inner canthal ligament. In the open-eye (OP) state, points A and B are on the skin edge of the epicanthal fold. Point A is at the upper end of the epicanthal fold, point B is the point of confluence of the epicanthal fold with the lower eyelid skin, point C is the upper punctum lacrimale, point E is the lower punctum lacrimale, and point D is the medial-most point of the lacrimal lake. Two tension-releasing incisions (lines a and c) are most widely used in Chinese patients undergoing epicanthoplasty: Incision line a, is a tension-releasing incision parallel to the lower inner canthal mucocutaneous junction, 4–5 mm away from the mucocutaneous junction, while incision line c originates from point B to point D. Incision line c is associated with a potential operative risk with crossover to the lacrimal canaliculus. Incision line b, which points toward the lacrimal lake, courses along the skin projection of the inner canthal ligament. Incision line b is slightly modified from line c. Most of the inner canthal ligament is in the reverse extension line (DF′) of the bisector (DF) of the inner canthal angle (∠CDE)

Injuries to the canalicular system have not been reported in the literature, and in fact, the canaliculi are not easily cut without involvement of the eyelid margin [1].

However, as shown in Fig. 1, incision line c is associated with a potential operative risk with crossover to the lacrimal canaliculus. *Gray's Anatomy* [14] states that the lacrimal canaliculus eventually joins the lacrimal sac between the anterior and posterior lacrimal crests, posterior to the inner canthal ligament and anterior to the lacrimal part of the orbicularis oculi muscle. According to the above-mentioned anatomical structure between the lacrimal drainage system and inner canthal ligament, as shown in Fig. 1, we designed a novel epicanthal tension-releasing incision based on the skin projection of the inner canthal ligament (Fig. 1, line b) to more effectively release the epicanthal tension and protect the lacrimal canaliculus during epicanthoplasty. This incision (line b) is slightly modified from line c, and it is consistent with the projection of the inner canthal ligament.

In the present study, we compared two groups of patients who underwent two different dermatic tension-releasing incisions during epicanthoplasty: incision line a, which was parallel to the lower inner canthal mucocutaneous junction (Fig. 1, line a), and line b, which was modified from line c and extended along the skin projection of the inner canthal ligament (Fig. 1, line b). We found that incision line b more effectively released the epicanthal tension than did line a.

Materials and Methods

From December 2014 to March 2016, we performed Z-epicanthoplasty or V–W epicanthoplasty with a simultaneous double-eyelid operation in 30 female patients. The patients' ages ranged from 18 to 32 years (average age, 24.3 years). The 30 patients were divided into two groups according to the types of the epicanthal tension-releasing incision performed during epicanthoplasty. Each group comprised 15 patients and 30 eyes. In Group A, incision line a was performed (tension-releasing incision parallel to the lower inner canthal mucocutaneous junction, 4–5 mm away from the mucocutaneous junction). In Group B, incision line b was performed (tension-releasing incision pointing toward the lacrimal lake, along the skin projection of the inner canthal ligament). The follow-up period ranged from 3 months to 2 years (Fig. 1).

Surgical Design and Epicanthoplasty Technique

The key to epicanthoplasty is a thorough understanding of the dynamic mechanism of the double eyelid and epicanthus [6].

In this study, all preoperative designs were performed in either open eyes (OP state) or in open eyes with pulling of the nasal skin in the medial direction (OPP state). In the OP state, the dynamic relationship between the two tarsal plates and inner canthal ligament is based on the anatomical structure; that is, the inner canthal ligament passes from the medial ends of the two tarsal plates to the anterior lacrimal crest and the frontal process of the maxilla. In the OP state, we found that most of the inner canthal ligaments were in the reverse extension line (DF') of the angular bisector (DF) of the inner canthal angle (∠CDE) (Fig. 1). We considered that this finding was due to the dynamic relationship between the two tarsal plates and inner canthal ligament (Fig. 2).

In the OP state, points A and B were on the skin edge of the epicanthal fold. Point A was at the upper end of the epicanthal fold, point B was the point of confluence of the epicanthal fold with the lower eyelid skin, point C was the upper punctum lacrimale, point E was the lower punctum lacrimale, and point D was medial-most point of the lacrimal lake. Force 1 (f_1) arose from the superior tarsus, and force 2 (f_2) arose from the inferior tarsus. The resultant force (f) of f_1 and f_2 followed the parallelogram law. Force′ (f') arose from the inner canthal ligament. Forces f and f' followed the law of action and reaction; that is, $-f = f'$. We inferred that the location of the inner canthal ligament was close to the direction of f' and that its counteracting force f was close to the bisector of ∠CDE. This may also explain why we found that most of the inner canthal ligaments were close to the reverse extension line of the bisector of ∠CDE in the OP state (Fig. 2).

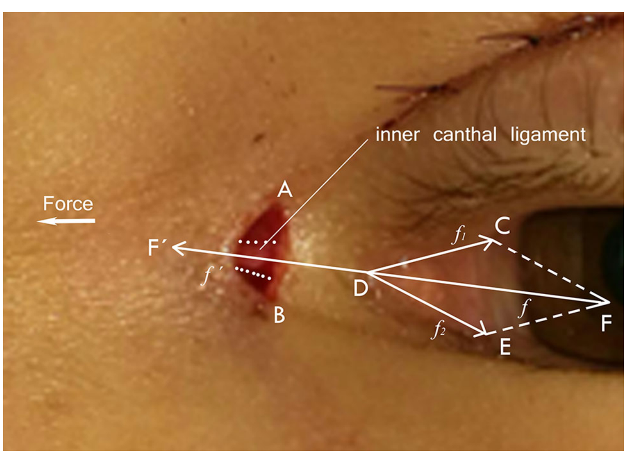

Fig. 2 Dynamic relationship of the epicanthus. Force 1 (f_1) comes from the superior tarsus, and force 2 (f_2) comes from the inferior tarsus. The resultant force (f) of f_1 and f_2 follows the parallelogram law. Force′ (f') comes from the inner canthal ligament. Forces f and f' follow the law of action and reaction; that is, $-f = f'$. The location of the inner canthal ligament is close to the direction of f', and its counteracting force f is close to the bisector of ∠CDE. Most of the inner canthal ligament is close to the reverse extension line of the bisector of ∠CDE in the OP state

After preoperative evaluation and patient counseling, all patients' upper eyelids were marked for double-eyelid blepharoplasty in the sitting position. Then all patients accepted a design of epicanthoplasty in the OP state. All surgeries were performed under local anesthesia with the patients in the supine position. Epicanthoplasty was performed after double-eyelid blepharoplasty.

In Group A, the locations of points A, B, C, D, E, F, and F′ were the same as described above. Point G was in the vicinity of the midpoint of line DE. The epicanthal tension-releasing incision line BG was designed in the OPP state (Fig. 3a,b). Line BG was parallel with the lower inner canthal mucocutaneous junction line DE and 4–5 mm away from DE in the OPP state. The location of point H was determined by the defect caused by incision BG during the operation (Fig. 3b). The skin of the nose was pulled medially (in the OPP state) to show lines AB and BG. After performing incisions along lines AB and BG, subcutaneous dissection was performed around the incision from the upper eyelid side to the lower eyelid side, undermining a wide range on the medial side. The inner canthal ligament was clearly exposed. When cutting open line BG, we elevated the skin flap and dissected the oblique fibrous band that was located just beneath the skin flap and that had caused vertical tension in the epicanthal fold [15] (Fig. 3b). In the OPP state, we photographed the inner canthus to measure the defect angle (∠BGB′). Flap HIB was designed according to the size of defect BGB′. Flap HIB was then rotated toward defect BGB′. Point I′ was sutured to point G, and point B′ was sutured to point H. Finally, the excessive skin flap tissue was trimmed and the incision closed with 8–0 nylon suture (Fig. 3b–d) (Video 1).

In Group B, the locations of points A, B, C, D, E, F, and F′ were the same as described above (Figs. 1, 2). Point G was located on the eye-side of line AB and 2–3 mm away from point K, which was designed at the intersection point of lines AB and DF′ in the OPP state. Incision AB was made, and wide subcutaneous dissection was performed as in Group A. The inner canthal ligament was clearly exposed. Incision KD was made using a scissors along the skin projection of the inner canthal ligament (Figs. 1, 4a). Skin flaps AK′D and BK″D were elevated, and the oblique fibrous band just beneath the skin flaps was carefully dissected. In the OPP state, we photographed the inner canthus for measurement of the defect of ∠K′DK″. The skin in the areas AK′GA and Bk″G′B in Fig. 4c, was moved to decrease the size of the postoperative scars associated with flaps AK′D and BK″D. In the OPP state, the remaining skin flaps AGD and BG′D were fixed in the corresponding position of the orbicularis oculi muscle (Fig. 4c). In the OP state, the skin of area AHIJBA along the projection of line AGDG′B was moved, and the orbicularis oculi muscle beneath it was partially resected or simply cut off with repositioning of the muscle

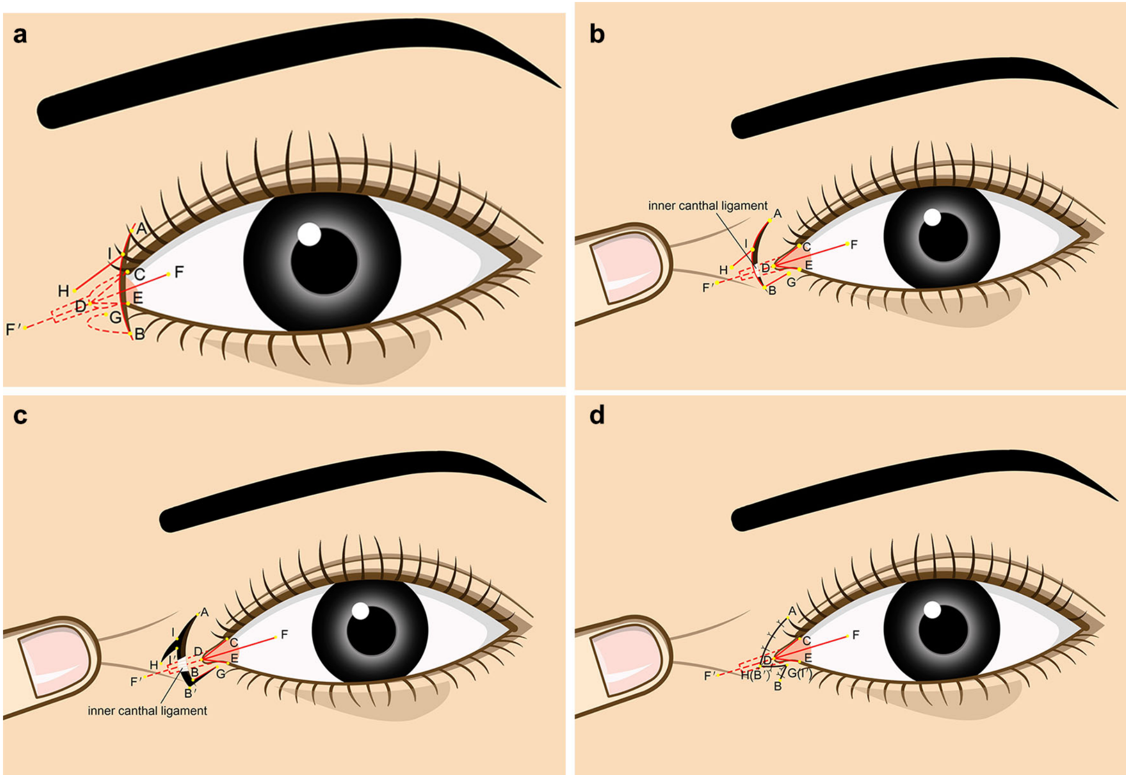

Fig. 3 **a** Surgical design in Group A. The locations of points A, B, C, D, E, F, and F′ are the same as described above (Figs. 1, 2). Point G is in the vicinity of the midpoint of line DE. Line BG is designed with open eyes and pulling of the nasal skin in the medial direction (OPP state) [see (**b**) below]. Line BG is parallel with the lower inner canthal mucocutaneous junction line DE and 4–5 mm away from line DE in the OPP state. The location of point H should be determined by the defect of incision BG during the operation. **b** Surgical design in Group A. The skin of the nose is pulled in the medial direction (OPP state) to show lines AB and BG. Point G is in the vicinity of the midpoint of line DE. The location of point H should be determined by the defect of incision BG during the operation. **c** Surgical sketch map of Group A. In the OPP state, this sketch map shows the state after performing the incisions along lines AB and BG. Flap HIB is designed according to the size of defect BGB′. Flap HIB is performed and rotated toward defect BGB′. **d** Surgical sketch map of Group A. After flap HIB has been rotated to defect BGB′, point I′ is sutured to point G and point B′ is sutured to point H. Finally, the excessive skin flap tissue is trimmed and the incision closed with 8–0 nylon suture

fibers in the upper direction (Fig. 4d). Flap HIJ was trimmed according to the size of defect GDG′. Point H was then sutured to point G, point I–D, and point J–G′. Finally, the excess skin flap (dog ear) was trimmed and the incision closed with 8–0 nylon suture (Fig. 4e, f) (Video 2).

Results

Thirty female patients (mean age, 24.28 ± 4.28 years; range, 18–32 years) underwent either Z-epicanthoplasty or V–W epicanthoplasty with a simultaneous double-eyelid operation. The mean follow-up period was 14.33 ± 6.12 months (range, 3–24 months). All patients were Chinese. The surgical procedures were effective with natural results in most patients. No epicanthal fold recurrence or lacrimal canaliculus injury occurred. Mild redness of the scars was noted 1 month after the operation, but this redness faded in 6–12 months in all patients (Figs. 5, 6, 7).

In both groups, the sizes of the defect angles after performance of the epicanthal tension-releasing incision were measured intraoperatively and analyzed postoperatively using SPSS 22.0 statistical software (IBM Corp., Armonk, NY, USA). The defect angles were measured with the ruler tool of Photoshop CS4 (Adobe, San Jose, CA, USA) (Group A, Fig. 8a, b; Group B, Fig. 8c, d). The defect angles are presented as the mean ± standard error of the mean from both groups. The defect angles significantly improved: those in Group B (86.59° ± 3.72°; range, 78.9°–92.4°) were significantly larger than those in Group A (55.24° ± 2.98°; range, 48.6°–61.0°) ($P < 0.0001$, Wilcoxon signed-rank test) (Fig. 9).

Discussion

An epicanthal fold, common in the eyelids of Asians, is a curved skin fold of the medial canthus that extends from the upper eyelid to the lower eyelid and partially hides the

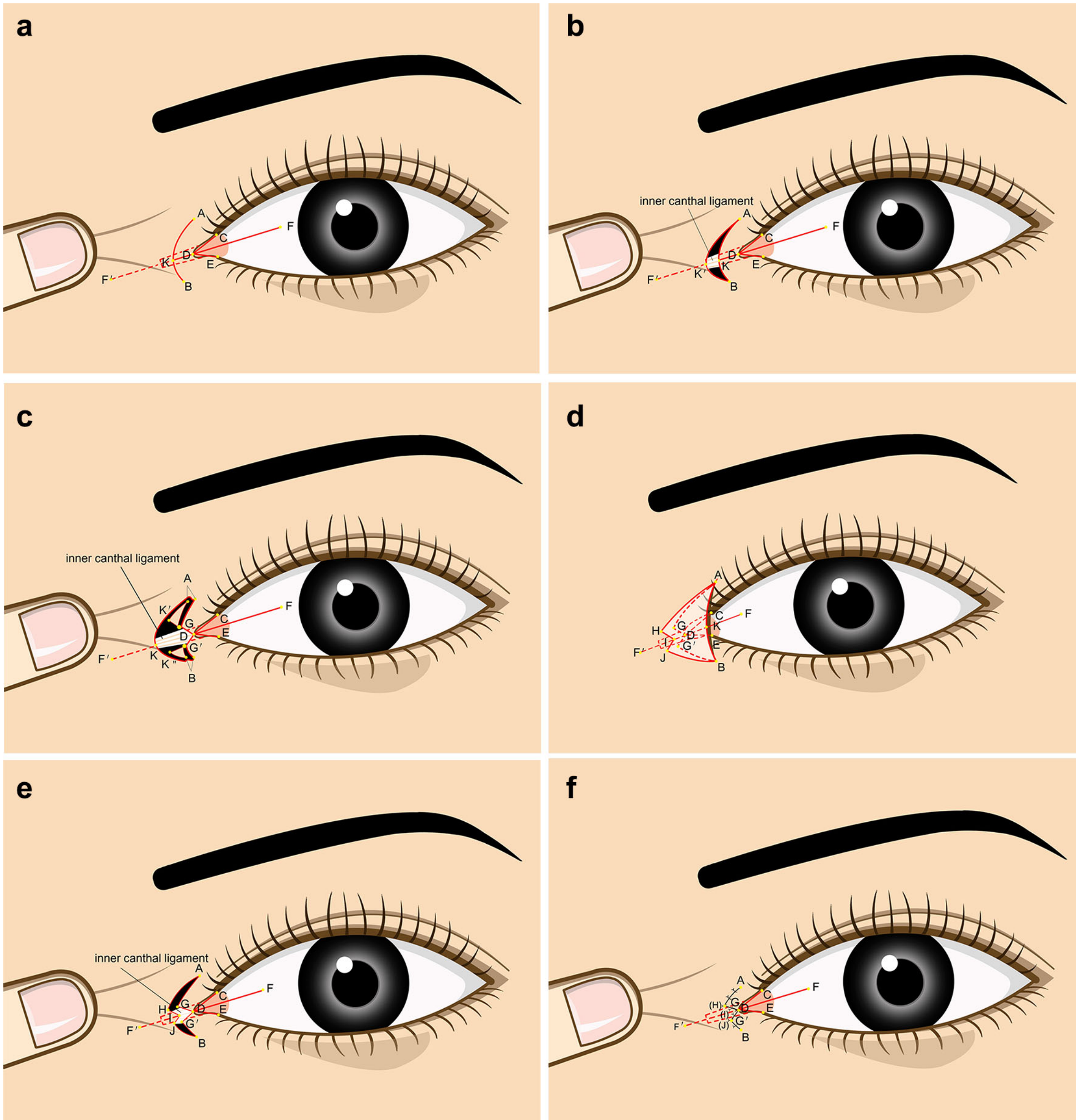

Fig. 4 **a** Surgical design of Group B. With open eyes and pulling of the nasal skin in the medial direction (OPP) state, the locations of points A, B, C, D, E, F, and F′ are the same as described above (Figs. 1, 2). Point K is designed after incision AB has been made and the inner canthus ligament has been clearly exposed during the operation. Incision KD is made along the skin projection of the inner canthal ligament. **b** Surgical design of Group B. In the OPP state, incision KD is made along the skin projection of the inner canthal ligament. **c** Surgical sketch map of Group B. In the OPP state, incision KD is made using a scissors along the skin projection of the inner canthal ligament. Skin flaps AK′D and BK″D are elevated, and the oblique fibrous band just beneath the skin flaps is carefully dissected. The dermatic areas AK′GA and BK″G′B are moved to decrease the size of the postoperative scars associated with flaps AK′D and BK″D. **d** Surgical sketch map of Group B. In the open-eye (OP) state, the skin of area AHIJBA along the projection of line AGDG′B is moved, and the orbicularis oculi muscle beneath it is partially resected or simply cut off with repositioning of the muscle fibers in the upper direction. **e** Surgical sketch map of Group B. In the OP state, after moving AHIJBA along the projection of line AGDG′B, flap HIJ is trimmed according the size of defect GDG′. **f** Surgical sketch map of Group B. In the OP state, after flap HIJ has been trimmed according to the size of defect GDG′, point H is sutured to point G, point I–D, and point J–G′. Finally, the excess skin flap (dog ear) is trimmed and the incision closed with 8–0 nylon suture

caruncula lacrimalis [6]. The pathogenesis of this skin fold has been thoroughly studied in the field of plastic surgery, and many epicanthoplasty techniques have been designed according to the anatomical characteristics of the epicanthus.

Several skin flap procedures have been introduced for correction of the epicanthus, such as the Mustard four-flap method, Johnson double Z-plasty, Root Z-epicanthoplasty, V–W plasty, Y–W plasty, V–Y advancement, and others. However, procedures that remove the tension caused by

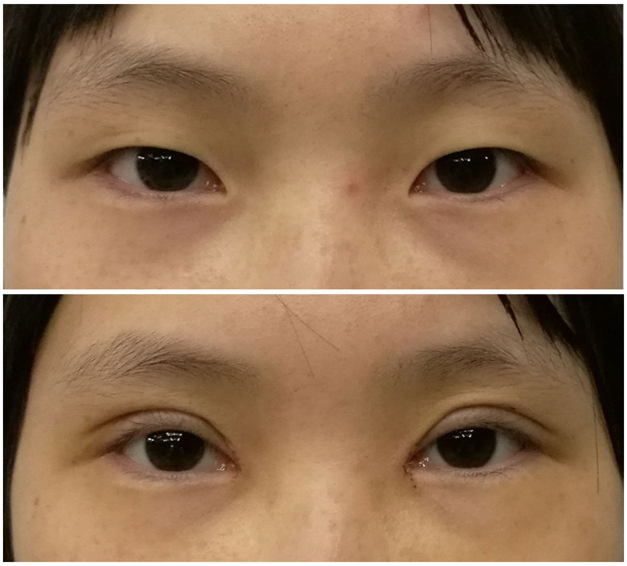

Fig. 5 Patient in Group A: preoperatively and 10 days postoperatively

Fig. 6 Patient in Group B: preoperatively and 1 month postoperatively

connective tissue and muscle beneath the skin have seldom been mentioned [15]. Furthermore, skin flap procedures often result in complications involving recurrence of the epicanthal fold and prominent scars on the medial canthal area.

The preseptal part of the orbicularis oculi muscle extends obliquely around the medial canthus to form the epicanthal fold [1]. Intermingled, abnormally aligned, or hypertrophic muscular fibers and other fibrotic tissue connecting the upper preseptal muscle to the lower preseptal muscle are simultaneously found in the inner canthus in patients with an epicanthal fold [2]. The abnormal tension in the epicanthal area originates from two sites. One site is the deep tissue layers, e.g., in patients with abnormal alignment, hypertrophy of the orbicularis oculi muscle, and excess fibrofatty tissues between the orbicularis oculi muscle. The other site is the superficial tissue layers, e.g., in patients with excessive epicanthal skin [3, 8, 16]. An essential aspect of epicanthoplasty is successful release of this epicanthal tension force. Therefore, many methods have been designed with a focus on releasing the epicanthal tension by partially cutting the epicanthal dense connective tissue of the deep layer [6] and rearranging the orbicularis oculi muscle to remove the epicanthal tension, mainly in the preseptal portion, above the medial canthal tendon [15, 17]. However, few procedures reportedly involve tension release of the superficial layer of skin.

Clinically, we have found that complete correction of the epicanthus is difficult using a simple elliptical or horizontal excision method that only releases the epicanthal tension of the muscular layer without the skin layer; additionally, we observed a higher rate of epicanthal recurrence postoperatively. This outcome suggests that the superficial layer of the dermis, which is rich in fibrous tissue, is one of the main causes of epicanthal tension other than misalignment and hypertrophy of the orbicularis oculi muscle. Epicanthoplasty with flap reconstruction after releasing both muscular and dermatic tension provides excellent operative outcomes [6]. Use of a flap during epicanthoplasty readily leads to prominent incisional scarring; however, success of flap methods can be markedly enhanced with minimal scarring by sufficiently releasing the epicanthal tension, reducing the area of the flap, and using noninvasive techniques and microsurgical sutures (Fig. 7).

Based on the theory of species evolution, the anatomical structure of the eye has changed to adapt to the human upright position. In the OP state with the patient in the upright position, the lower eyelid is almost motionless and the upper eyelid is lifted by the levator palpebrae superioris and Müller's muscle, which evolved muscularly to oppose gravity. The levator palpebrae superioris, traditionally considered to be a single muscle layer, distally gives rise to two lamellae below Whitnall's ligament: the anterior lamella, which becomes the aponeurosis, and the posterior lamella, which becomes Müller's muscle [18, 19]. The levator aponeurosis attaches to the inferior one-third of the tarsal plate and subcutaneous tissue, constituting the medial horn and lateral horn in the medial and lateral canthus, respectively. Upon eye opening, the medial horn pulls the inner canthal ligament, moving in a superoposterior direction [20]. Two tension-releasing incisions are most widely used during epicanthoplasty in Chinese patients. Incision line a (Fig. 1) is below the inner canthal ligament and parallel to the inner canthal mucocutaneous junction (white

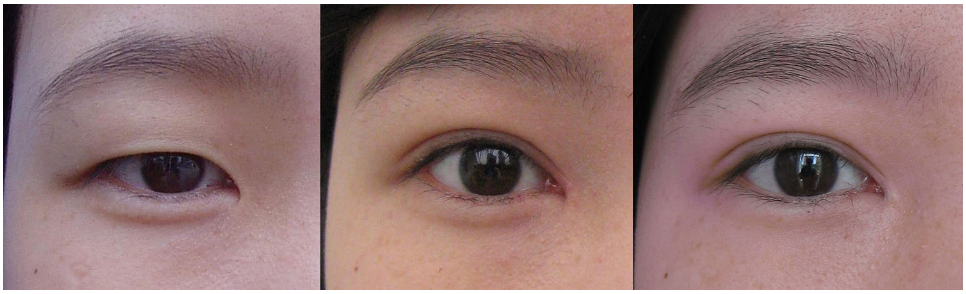

Fig. 7 Patient in Group B: preoperatively, 8 months postoperatively, and 18 months postoperatively. This picture shows that the flap method can be performed with minimal scarring through sufficient release of epicanthal tension, reduction in the area of the flap, and use of noninvasive techniques and microsurgical sutures

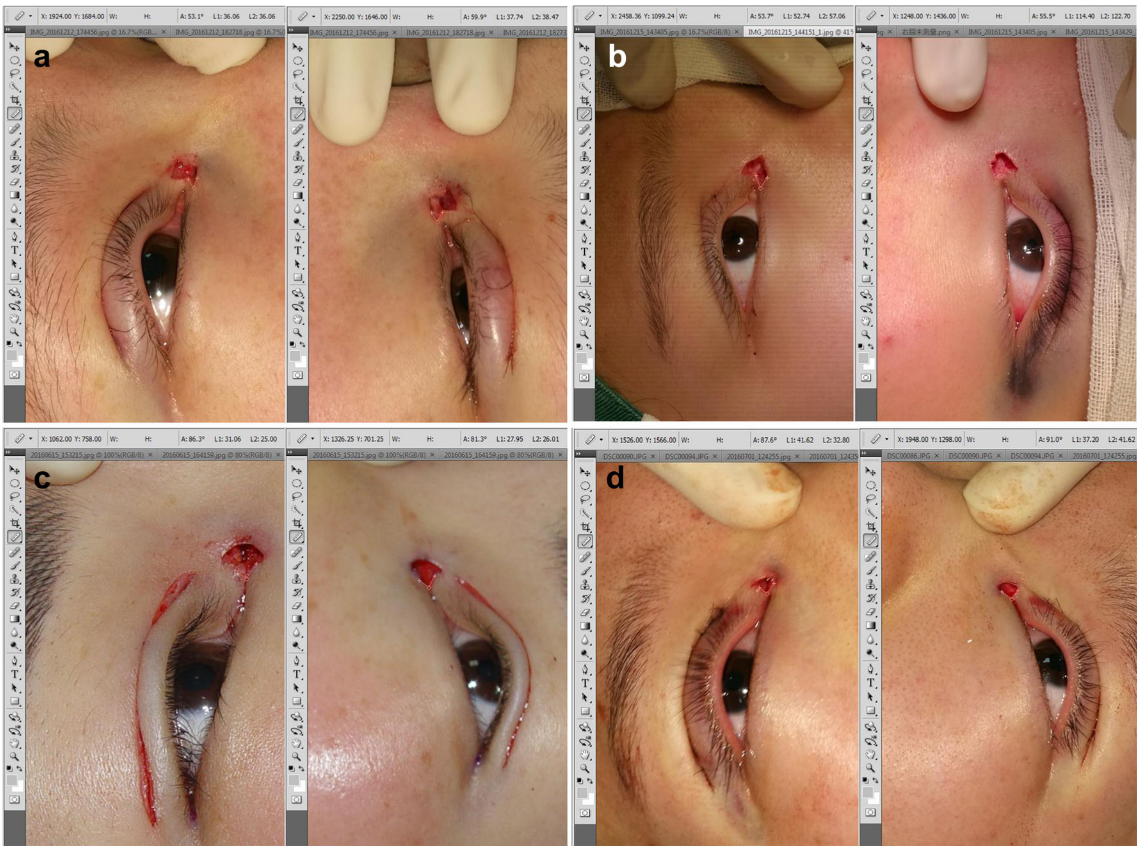

Fig. 8 **a** A patient in Group A. With open eyes and pulling of the nasal skin in the medial direction (OPP state), we intraoperatively photographed the inner canthus in order to measure the defect angle (∠BGB′) (see Fig. 3c above). The defect angle was measured with the ruler tool of Photoshop CS4 (Adobe, San Jose, CA, USA). **b** Another patient in Group A. In the OPP state, we intraoperatively photographed the inner canthus to measure the defect angle (∠BGB′) (see Fig. 3c above). The defect angle was measured with the ruler tool of Photoshop CS4 (Adobe). **c** A patient in Group B. In the OPP state, we intraoperatively photographed the inner canthus to measure the defect angle (∠K′DK″) (see Fig. 4c above). The defect angle was measured with the ruler tool of Photoshop CS4 (Adobe). **d** Another patient in Group B. In the OPP state, we intraoperatively photographed the inner canthus to measure the defect angle (∠K′DK″) (see Fig. 4c above). The defect angle was measured with the ruler tool of Photoshop CS4 (Adobe)

line) of the lower eyelid. Line c (Fig. 1) is also below the inner canthal ligament and points toward the medial-most point of the lacrimal lake. The levator muscle fibers of the upper eyelid only reach the inner canthal ligament [20]. Therefore, in the OP state, the strength of the levator muscles in the upper eyelid is difficult to fully transfer to the area below the inner canthal ligament. The tension-releasing incisions lines a and c are both below the inner canthal ligament, making it difficult for them to fully release the tension of the epicanthal skin. We designed our epicanthal tension-releasing incision (line b) by slightly modifying line c and moved it upward, consistent with the skin projection of

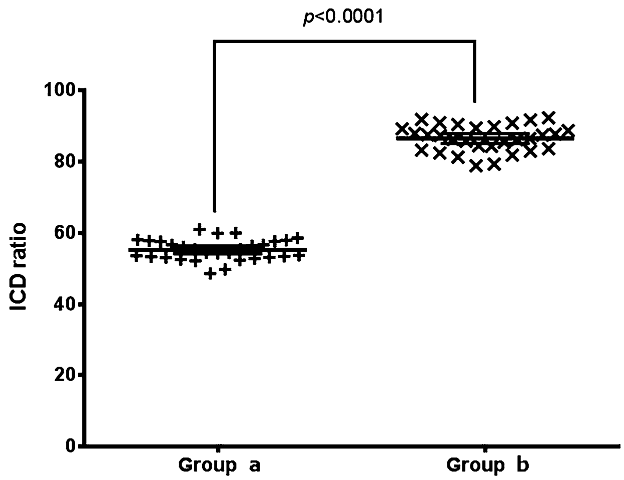

Fig. 9 Intraoperative defect angles are presented as the mean ± standard error of the mean from the two groups. The defect angles in Group B (86.59° ± 3.72°; range, 78.9°–92.4°) were significant larger than those in Group A (55.24° ± 2.98°; range, 48.6°–61.0°) ($P < 0.0001$, Wilcoxon signed-rank test)

the inner canthal ligament. Line b can more effectively release the epicanthal tension and protect the lacrimal canaliculus during epicanthoplasty (Fig. 1). In the present study, we analyzed the defect angles of two groups of patients after performing epicanthal tension release. The defect angles significantly improved: The defect angles in Group B (86.59° ± 3.72°; range, 78.9°–92.4°) were significantly larger than those in Group A (55.24° ± 2.98°; range, 48.6°–61.0°) ($P < 0.0001$) (Fig. 9). This outcome demonstrates that the skin incision line b more effectively releases the tension of the epicanthal skin than does line a.

No injuries to the canalicular system have been reported in the literature, and in fact, the canaliculi are not easily cut without involvement of the eyelid margin [1]. However, as shown in Fig. 1, all incisions (lines a, b, and c) are associated with a potential operative risk involving injury to the lacrimal canaliculus. Hwang et al. [21] observed serial sagittal sections of cadavers' lower lacrimal canaliculus under a light microscope. They found that a vertical portion of the canaliculus was about 1 mm (1.11 ± 0.16 mm) deep and that the horizontal portion was about 2–3 mm (2.08 ± 2.74 mm) long 2 mm below the mucocutaneous junction, where an incision may be made during epicanthoplasty. The lacrimal canaliculus eventually joins the lacrimal sac between the anterior and posterior lacrimal crests, posterior to the inner canthal ligament and anterior to the lacrimal part of the orbicularis oculi muscle. Performance of an epicanthal tension-releasing incision based on the skin projection of the inner canthal ligament (Fig. 1, line b) does not injure the lacrimal drainage system because the inner canthal ligament effectively protects the lacrimal canaliculus.

Two operative techniques for correction of the epicanthus are used in the clinical setting. In the first technique, the flaps are designed preoperatively, and the surgeons then perform the operation strictly according to the preoperative design [6, 8, 11, 13, 22]. In the second technique, the preoperative design is used for reference only. In this method, after releasing tension with a dermatic incision and muscular treatment, the defect is sutured and the dog ear is trimmed according to the specific requirements of the skin flap [3, 23]. The second procedure which we often used in clinic involves the following operative steps: Step 1, tension is safely released and a transversal defect is formed; step 2, the flap on the defect side is trimmed and reduced; step 3, the flap is designed from the excessive skin on the nasal side to repair the defect; step 4, the dog ear is trimmed according to the specific requirements of the skin flap; and step 5, the incision is sutured. According to the Duke–Elder classification, medial epicanthal folds are divided into four types: epicanthus supraciliaris, epicanthus palpebralis, epicanthus tarsalis, and epicanthus inversus. The second surgical procedure can be used to treat almost all types of epicanthus. After step 3 in the above-mentioned procedure, if the dog ear is located only on one side of the defect (above or below), the unilateral dog ear is trimmed, and a Z-plasty is performed. If the dog ears are located on both sides of the defect, the bilateral dog ears are trimmed, and a V–W plasty is performed.

Conclusion

The herein-described epicanthal dermatic tension-releasing incision based on the skin projection of the inner canthal ligament is a safe, effective tension-releasing incision in epicanthoplasty. It facilitates creation of a more esthetic epicanthal appearance with an inconspicuous scar and no injury to the lacrimal apparatus.

Compliance with Ethical Standards

Conflicts of interest The authors declare that they have no conflicts of interest to disclose.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

References

1. Saonanon P (2016) The new focus on epicanthoplasty for Asian eyelids. Curr Opin Ophthalmol 27:457–464
2. Park JW, Hwang K (2016) Anatomy and histology of an epicanthal fold. J Craniofac Surg 27:1101–1103

3. Park DH, Park SU, Lee BK et al (2014) Medial epicanthoplasty without a vertical scar. Ann Plast Surg 73:8–11
4. Sa HS, Lee JH, Woo KI et al (2012) A new method of medial epicanthoplasty for patients with blepharophimosis-ptosis-epicanthus inversus syndrome. Ophthalmology 119:2402–2407
5. Wang S, Shi F, Luo X et al (2013) Epicanthal fold correction: our experience and comparison among three kinds of epicanthoplasties. J Plast Reconstr Aesthet Surg JPRAS 66:682–687
6. Wang L, Chen X, Zheng Y (2013) A modified z-epicanthoplasty combined with blepharoplasty used to create an in-type palpebral fissure in Asian eyelids. Aesthet Plast Surg 37:704–708
7. Lu JJ, Yang K, Jin XL et al (2011) Epicanthoplasty with double eyelidplasty incorporating modified Z-plasty for Chinese patients. J Plast Reconstr Aesthet Surg JPRAS 64:462–466
8. Park JI (1996) Z-epicanthoplasty in Asian eyelids. Plast Reconstr Surg 98:602–609
9. Fujiwara T, Maeda M, Kuwae K et al (2006) Modified split V-W plasty for entropion with an epicanthal fold in Asian eyelids. Plast Reconstr Surg 118:635–642
10. Cho BC, Lee KY (2002) Medial epicanthoplasty combined with plication of the medial canthal tendon in Asian eyelids. Plast Reconstr Surg 110:293–300 **(discussion 301)**
11. Hu X, Lin X, Ma G et al (2012) Two-Z-epicanthoplasty in a three-dimensional model of Asian eyelids. Aesthet Plast Surg 36:788–794
12. Lyu D, Jin Y, Chang L et al (2017) The modified Z-epicanthoplasty-A stepwise and individualized design. Ann Plast Surg 78:7–11
13. Yoo WM, Park SH, Kwag DR (2002) Root Z-epicanthoplasty in Asian eyelids. Plast Reconstr Surg 109:2067–2071 **(discussion 2072–2063)**
14. Drake Richard L, Vogl Wayne, Mitchell Adam WM (2010) Gray's anatomy for students. Elsevier, Singapore
15. Kwon BS, Kong JS, Kim YW et al (2014) Corrective epicanthoplasty in patients with unnatural results of prior epicanthoplasty: rearrangement of the orbicularis oculi muscle above the medial canthal tendon. Ann Plast Surg 73:12–15
16. Yi SK, Paik HW, Lee PK et al (2007) Simple epicanthoplasty with minimal scar. Aesthet Plast Surg 31:350–353
17. Kao YS, Lin CH, Fang RH (1998) Epicanthoplasty with modified Y-V advancement procedure. Plast Reconstr Surg 102:1835–1841
18. Kakizaki H, Prabhakaran V, Pradeep T et al (2009) Peripheral branching of levator superioris muscle and Muller muscle origin. Am J Ophthalmol 148(800–803):e801
19. Saonanon P (2014) Update on Asian eyelid anatomy and clinical relevance. Curr Opin Ophthalmol 25:436–442
20. Kang H, Takahashi Y, Nakano T et al (2015) Medial canthal support structures: the medial retinaculum: a review. Ann Plast Surg 74:508–514
21. Hwang K, Kim DJ, Hwang SH (2005) Anatomy of lower lacrimal canaliculus relative to epicanthoplasty. J Craniofac Surg 16: 949–952
22. Park JI (2003) Root Z-epicanthoplasty in Asian eyelids. Plast Reconstr Surg 111:2476–2477
23. Sebastia R, Herzog Neto G, Fallico E et al (2011) A one-stage correction of the blepharophimosis syndrome using a standard combination of surgical techniques. Aesthet Plast Surg 35: 820–827